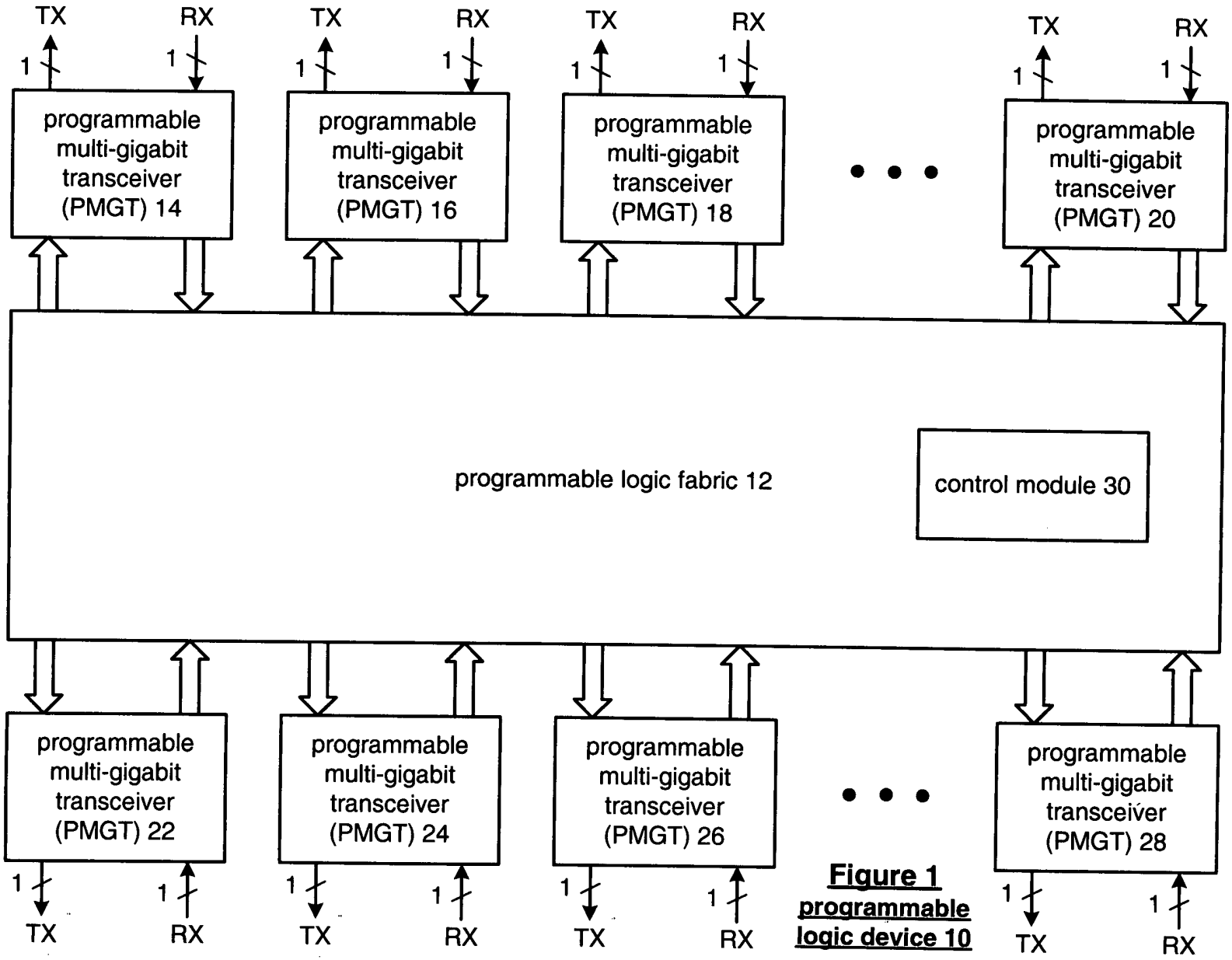


Figure 1
programmable logic device 10

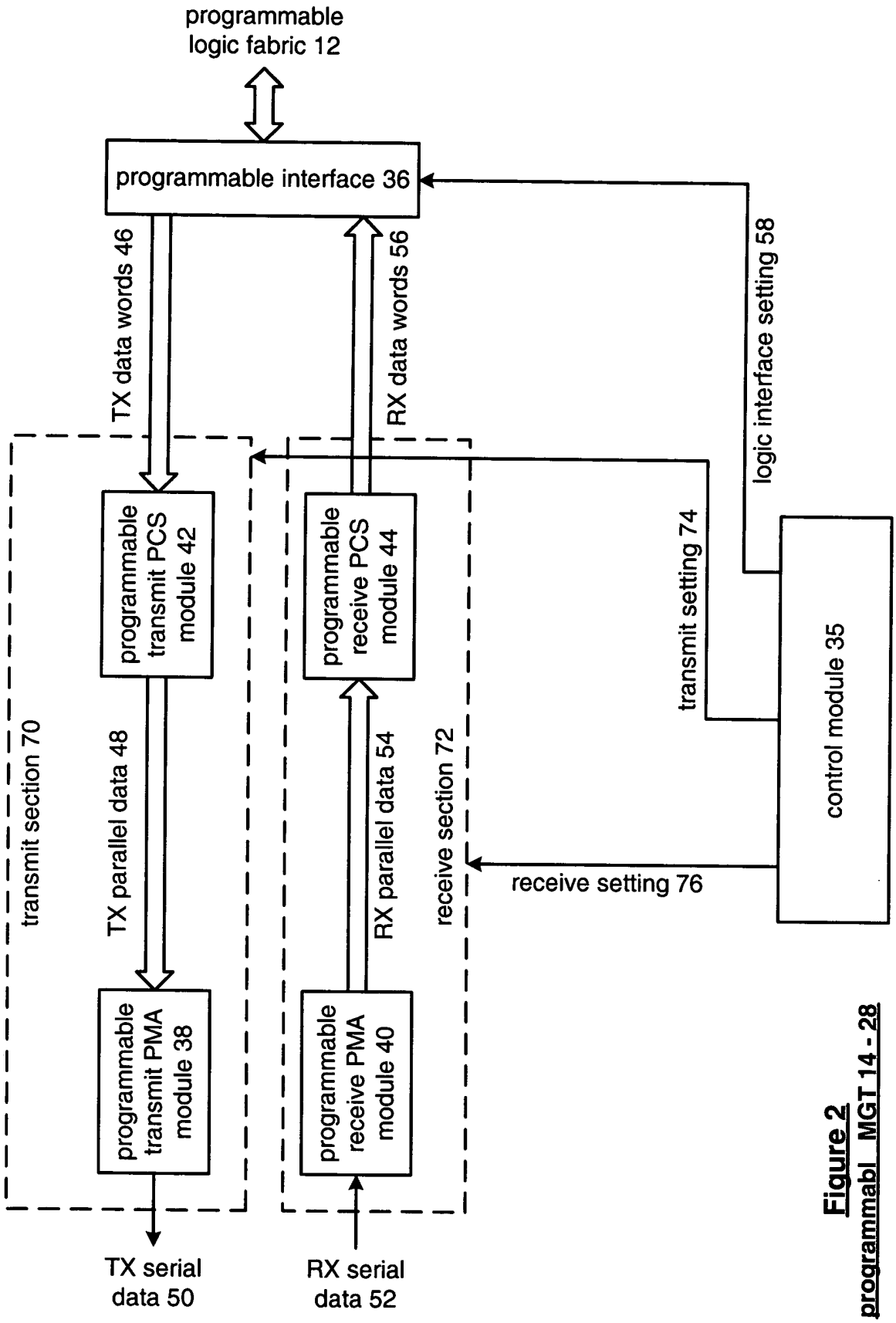


Figure 2
programmabl MGT 14 - 28

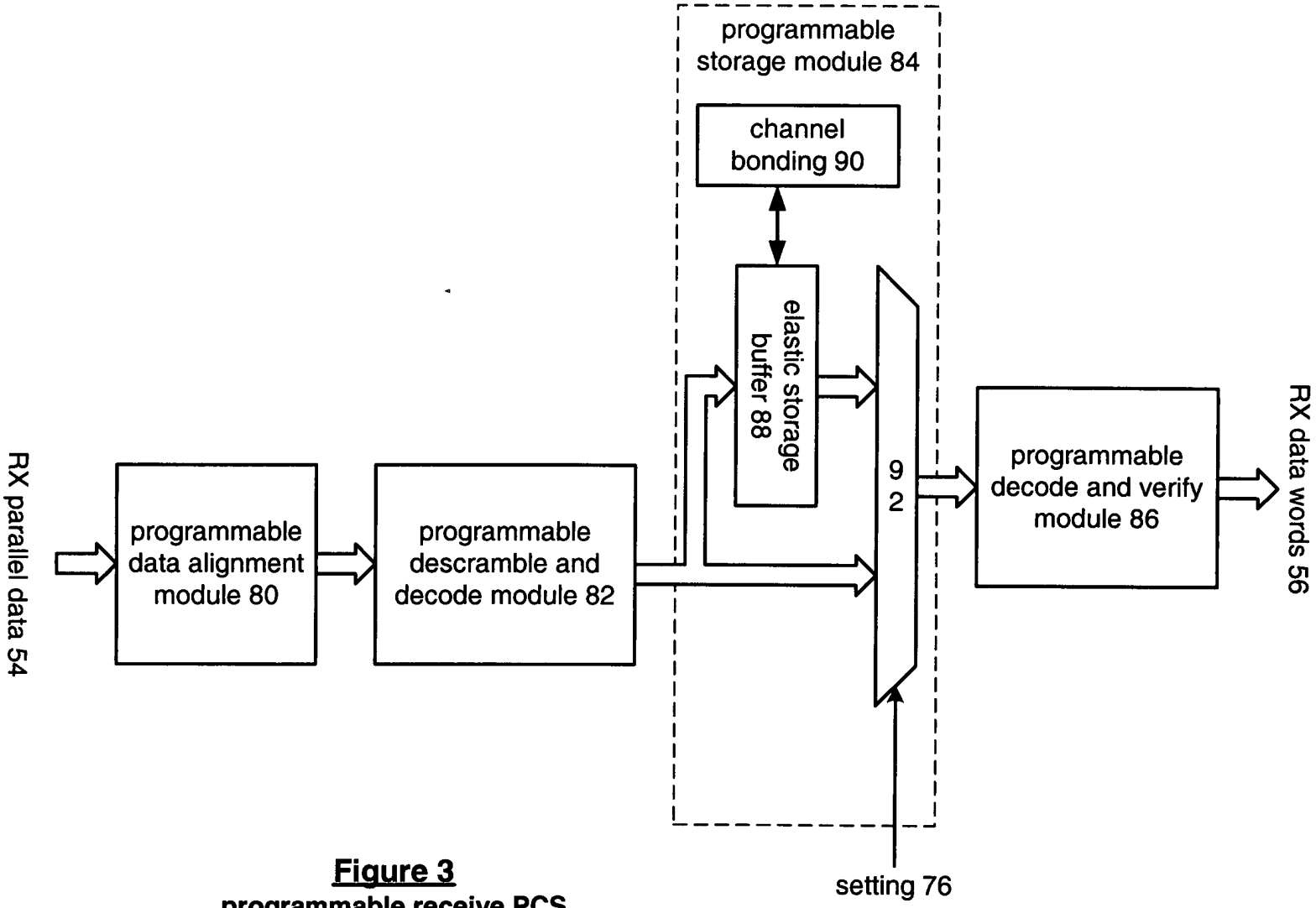


Figure 3
programmable receive PCS module 44

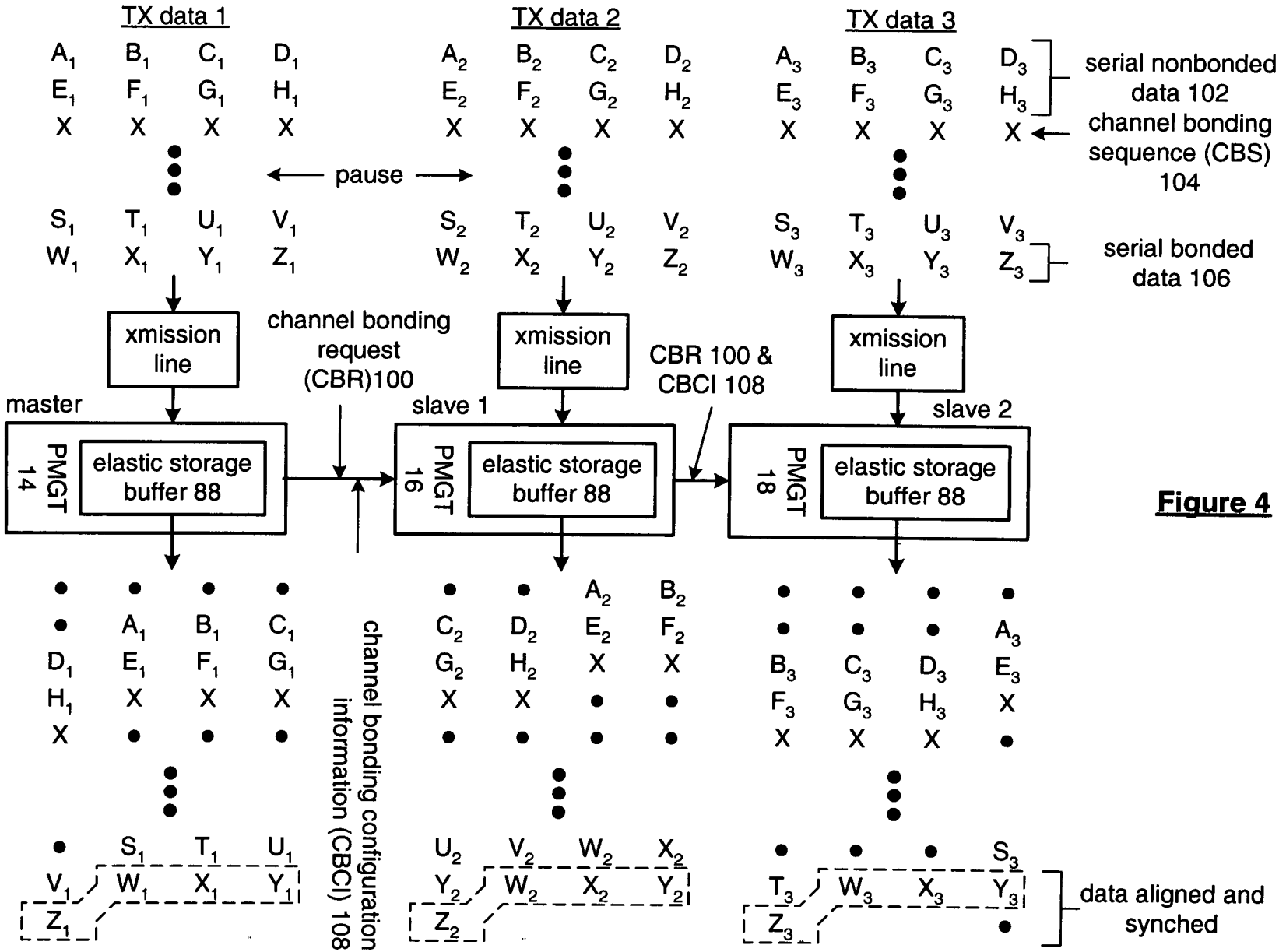

TX data 1
TX data 2
TX data 3
pause
serial nonbonded data 102
channel bonding sequence (CBS) 104
serial bonded data 106
xmission line
xmission line
xmission line
channel bonding request (CBR)100
CBR 100 & CBCI 108
master
slave 1
slave 2
PMGT 14
PMGT 16
PMGT 18
elastic storage buffer 88
elastic storage buffer 88
elastic storage buffer 88
channel bonding configuration information (CBCI) 108
data aligned and synched

Figure 4

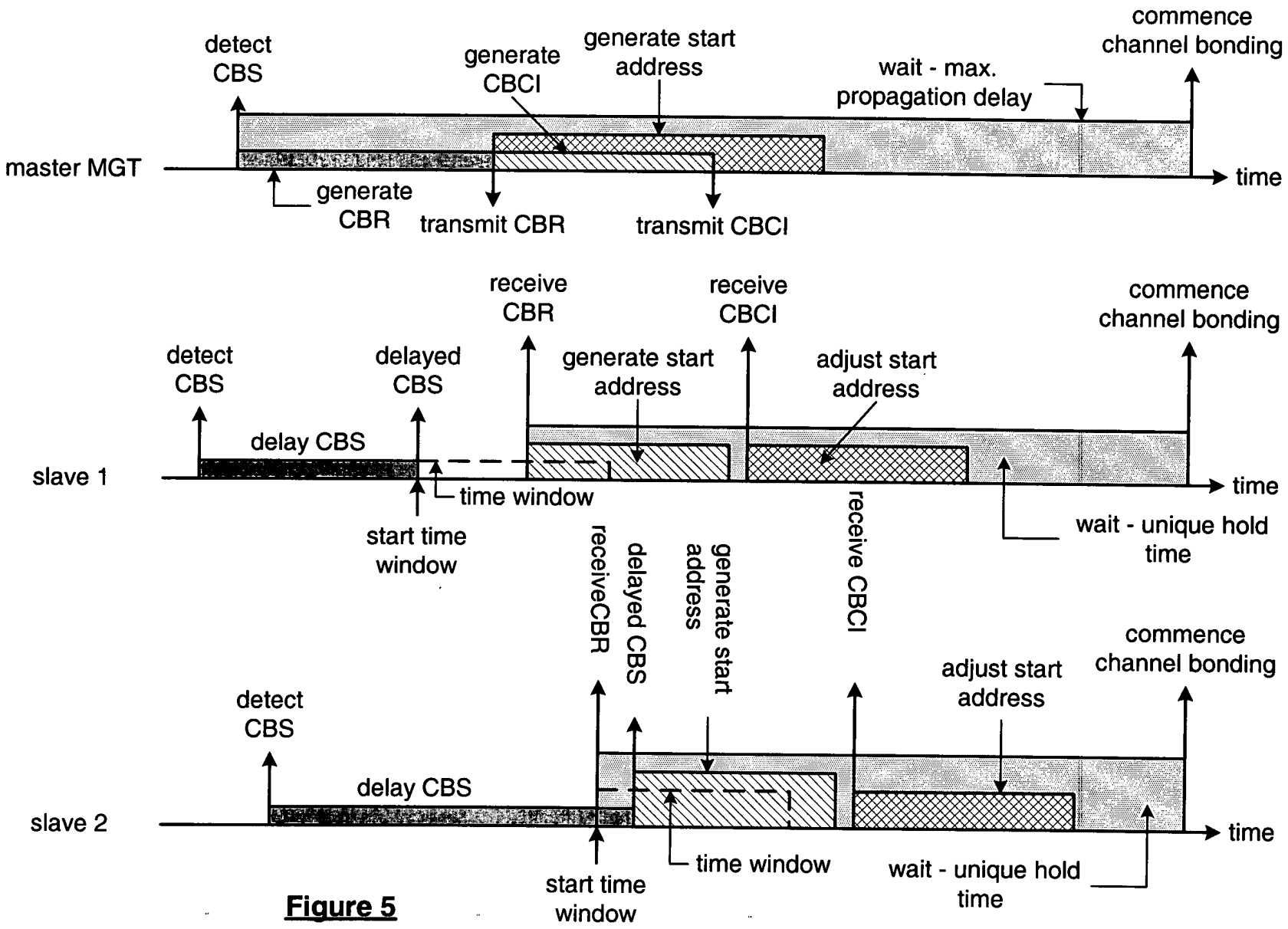

detect CBS
generate CBCI
generate start address
wait - max. propagation delay
commence channel bonding
master MGT
generate CBR
transmit CBR
transmit CBCI
time
receive CBR
receive CBCI
commence channel bonding
detect CBS
delayed CBS
generate start address
adjust start address
delay CBS
slave 1
time window
time
start time window
wait - unique hold time
receiveCBR
delayed CBS
generate start address
receive CBCI
commence channel bonding
adjust start address
detect CBS
delay CBS
slave 2
time window
time
start time window
wait - unique hold time

Figure 5

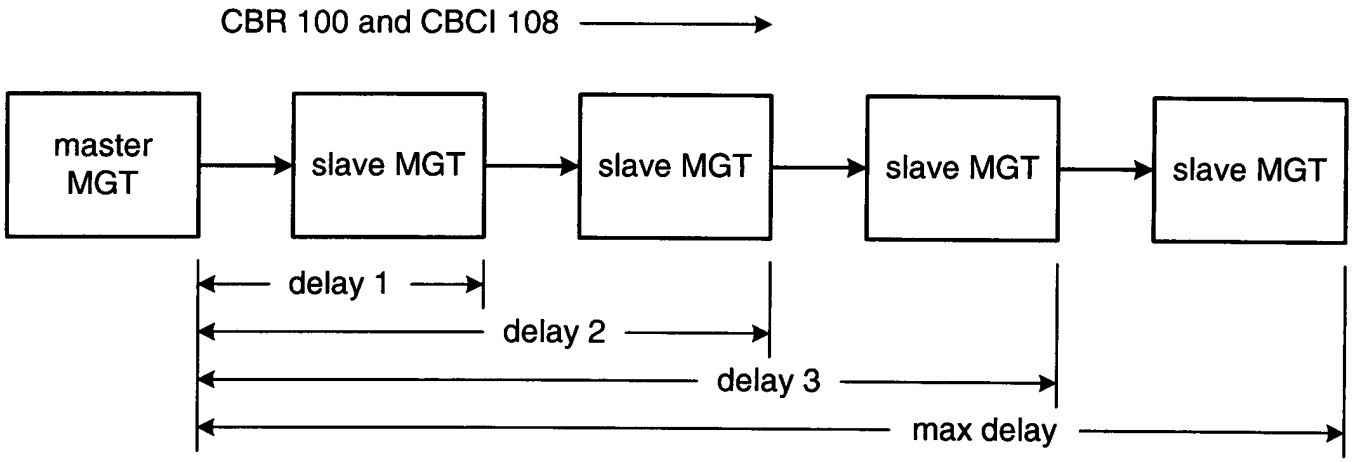
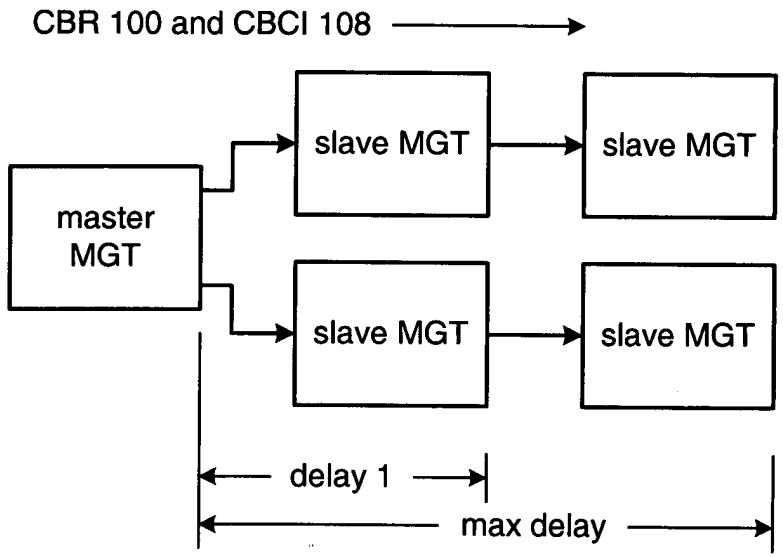


Figure 6

Figure 7



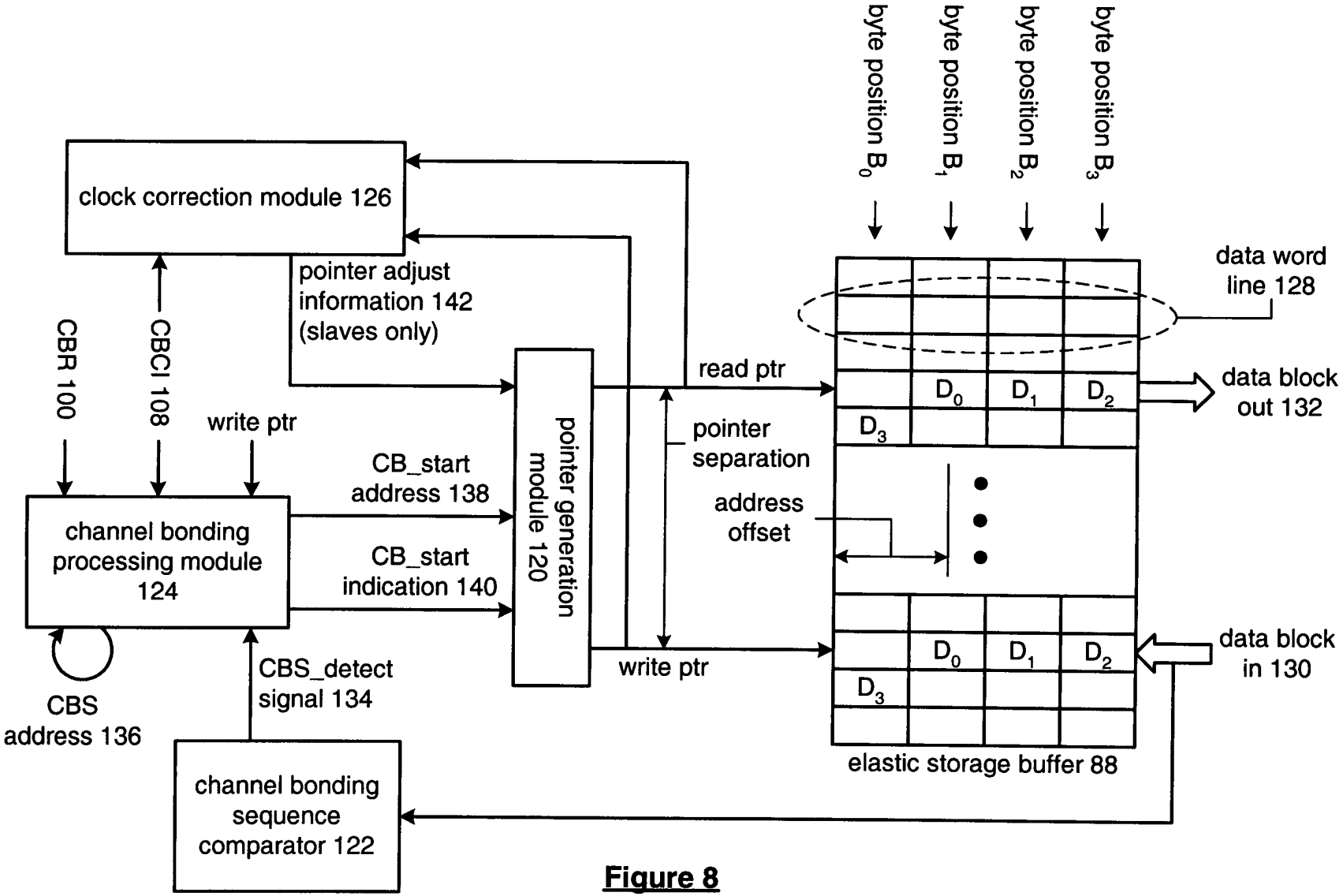


Figure 8

chann l bonding module 90

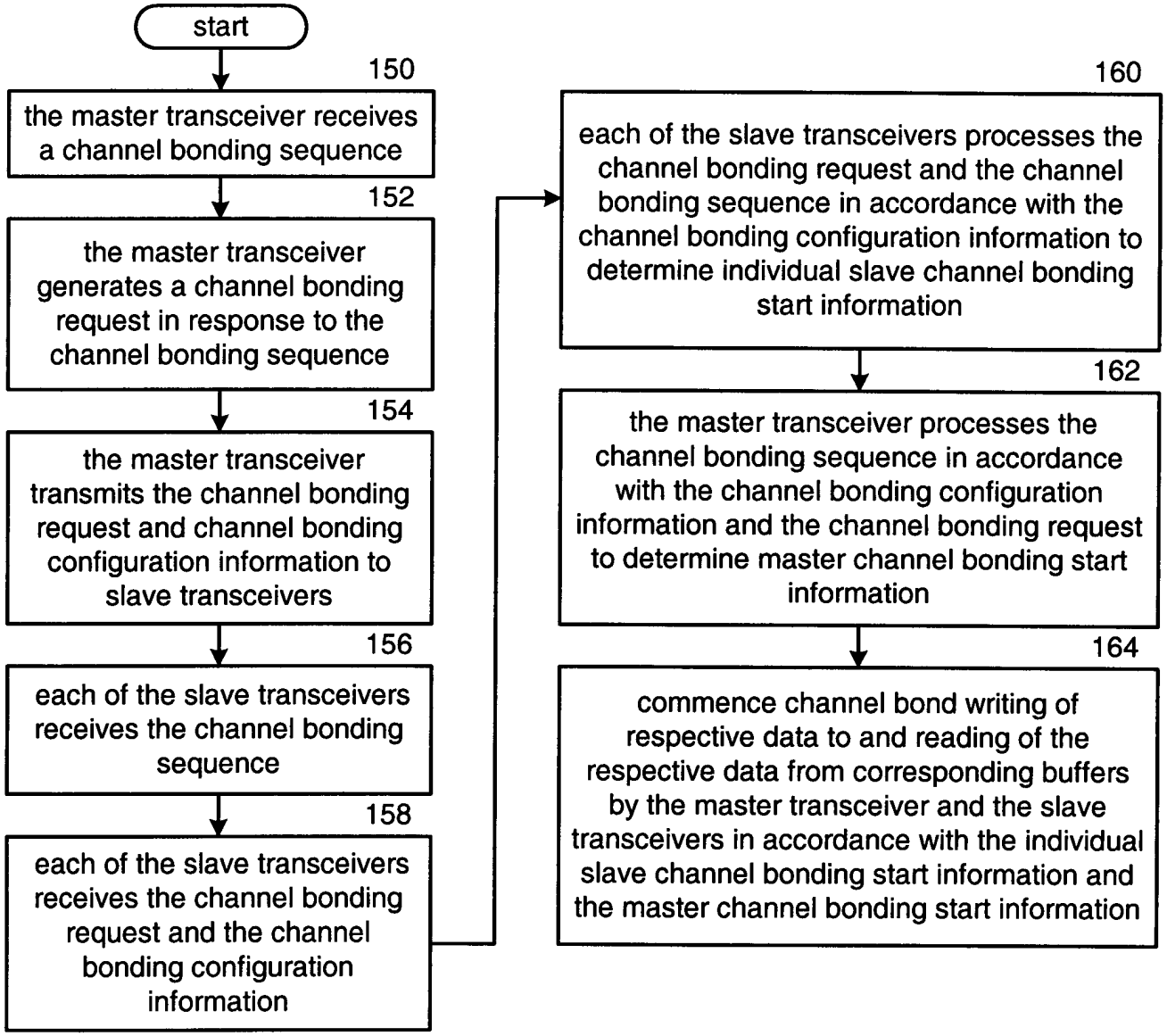

start
150
the master transceiver receives a channel bonding sequence
152
the master transceiver generates a channel bonding request in response to the channel bonding sequence
154
the master transceiver transmits the channel bonding request and channel bonding configuration information to slave transceivers
156
each of the slave transceivers receives the channel bonding sequence
158
each of the slave transceivers receives the channel bonding request and the channel bonding configuration information
160
each of the slave transceivers processes the channel bonding request and the channel bonding sequence in accordance with the channel bonding configuration information to determine individual slave channel bonding start information
162
the master transceiver processes the channel bonding sequence in accordance with the channel bonding configuration information and the channel bonding request to determine master channel bonding start information
164
commence channel bond writing of respective data to and reading of the respective data from corresponding buffers by the master transceiver and the slave transceivers in accordance with the individual slave channel bonding start information and the master channel bonding start information

Figure 9

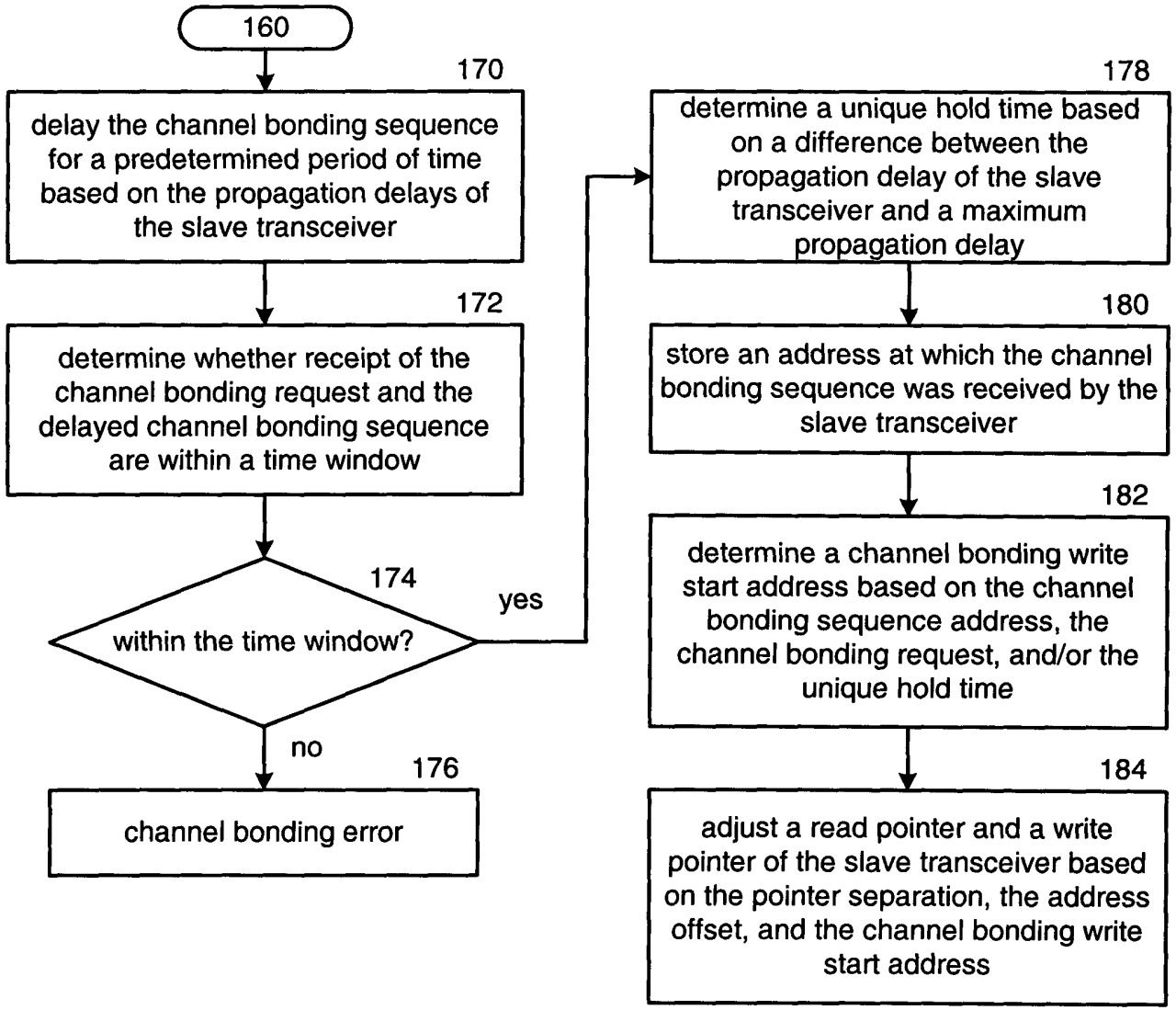

160
170
delay the channel bonding sequence for a predetermined period of time based on the propagation delays of the slave transceiver
172
determine whether receipt of the channel bonding request and the delayed channel bonding sequence are within a time window
174
within the time window?
yes
no
176
channel bonding error
178
determine a unique hold time based on a difference between the propagation delay of the slave transceiver and a maximum propagation delay
180
store an address at which the channel bonding sequence was received by the slave transceiver
182
determine a channel bonding write start address based on the channel bonding sequence address, the channel bonding request, and/or the unique hold time
184
adjust a read pointer and a write pointer of the slave transceiver based on the pointer separation, the address offset, and the channel bonding write start address

Figure 10

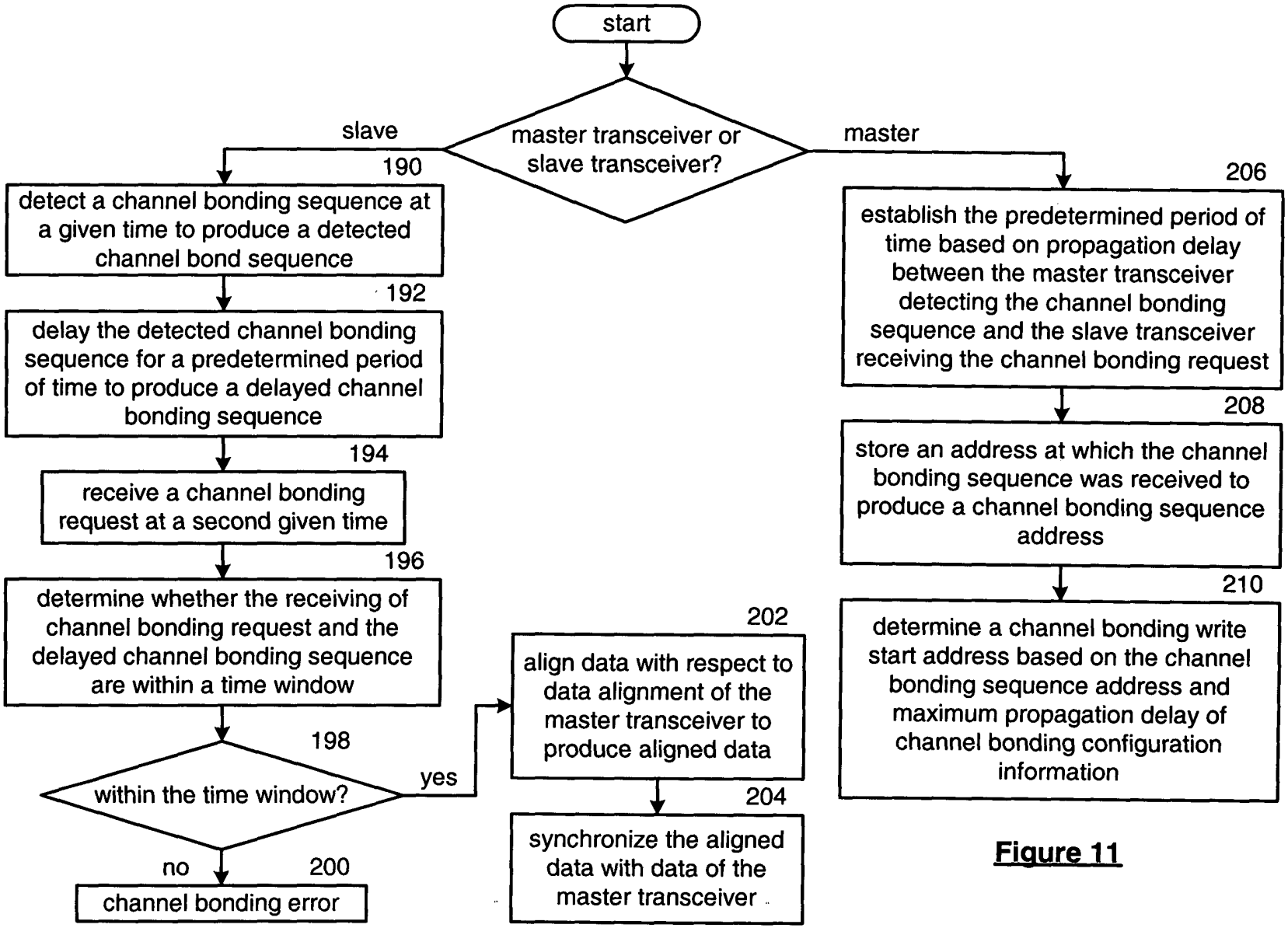

start
master transceiver or slave transceiver?
slave
master
190
detect a channel bonding sequence at a given time to produce a detected channel bond sequence
192
delay the detected channel bonding sequence for a predetermined period of time to produce a delayed channel bonding sequence
194
receive a channel bonding request at a second given time
196
determine whether the receiving of channel bonding request and the delayed channel bonding sequence are within a time window
198
within the time window?
yes
no
200
channel bonding error
202
align data with respect to data alignment of the master transceiver to produce aligned data
204
synchronize the aligned data with data of the master transceiver
206
establish the predetermined period of time based on propagation delay between the master transceiver detecting the channel bonding sequence and the slave transceiver receiving the channel bonding request
208
store an address at which the channel bonding sequence was received to produce a channel bonding sequence address
210
determine a channel bonding write start address based on the channel bonding sequence address and maximum propagation delay of channel bonding configuration information

Figure 11